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ABSTRACT

European institutions of higher education must let changing economic conditions play a bigger role in their decisions about what research to emphasize. As costs escalate, constraints on government spending force a shift of funding priorities toward research of more strategic value to industry. There are many ways that universities and industry seek mutually profitable connections. But the growing emphasis on short term industrial requirements may undermine the more basic university functions of general education and increase in fundamental knowledge. It is not yet clear whether the changing relations among universities and industry and government research policies foster a sense of European unity by identifying the commonality of problems and solutions or accentuates disunity by the growth of competition. If competitiveness is among Europe and Japan and the United States, unity will dominate. If, however, it is between bilateral conglomerates within Europe, disunity will result. If there is a rationalized plan of different mixes or differentiated models of pure and applied research and different science and technology curricula are emphasized depending on the strengths of particular universities and on varying contexts and sizes of countries, then that diversity can add up to unity. If universities, regardless of quality, or if nations, regardless of gross national product or population numbers or stage of development, attempt to replicate each other, then disunity will prevail. (JB)

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INDUSTRY: CATALYST OR DETERRENT TO UNITY EUROPE?

by
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Changing Relations Between Universities and Research Policy and Industry: Catalyst or Deterrent to Unity of Europe?

By Henry Wasser

A recent meeting of ministers of education from the twenty four members of the Organization for Economic Cooperation and Development (O.E.C.D.) concluded that academic research must be shaped increasingly by government's economic and social priorities, although the ministers acknowledge the importance of university autonomy.

Institutions of higher education should let changing economic conditions play a bigger role in their decisions about what research to emphasize. In cooperation with government and industry, universities must find a way to respond to broader national and regional goals.

In the words of Christoffer Taxell (Finland) - research in higher education is becoming more of "a commodity and strategic resource in social and economic development." Universities, therefore, "will be given set goals. They will be expected to produce results. They will be evaluated [and] at the same time attempts will be made to influence them from outside."

One model for that relationship is for cooperation between government and university to determine objectives and insure basic resources. Universities retain autonomy but are accountable for their product.

The Education Minister from Portugal Roberto Carneiro declared that the general and vocational trends in education had merged to meet the need for greater coordination between education and industry. The borderline between the two has become blurred; vocational institutions have broadened previous narrow, skill-oriented training, and schools have been focussing more on labor market needs.

National and regional economic and social objectives should be priorities, according to John Dawkins, Australian Minister of Education. With no major increase in public funding to be expected "institutions of higher education must become more entrepreneurial in outlook and increasingly self-sufficient in funding. In illustration he cited new funding models which "encourage institutions to bid competitively for new programme

funds related to national and regional priorities."

Attaining consensus in describing the on-going change, the member-representatives recognized common problems such as:

How do higher education systems respond to the needs of society without endangering their traditional role in the advancement of knowledge?

Lavish support and equipment for research fields such as bio-chemistry and informatics are at the cost of the rest of science.

In basic research limited funds are concentrated in a few institutions.

Increased professionalization of higher education courses has brought about a market increase in demand for career-oriented courses.

The need for an intermediate degree in between the first degree and the research-oriented doctorate has grown.

In general it was recognized by the ministers that constraints on government spending as costs escalate, force a shift of funding priorities towards research of more strategic value to industry. But the growing emphasis on short term industrial requirements may undermine the more basic functions of universities' general education and increase in fundamental knowledge. This change which compromises these primary functions, even though it may serve important and immediate requirements, may not be in the wider and longer term national or regional interests.

Moreover, the resultant growing body of new scientific knowledge would now be treated as confidential or proprietary information that is not published or only after a long time lapse, at the decision of industrial sponsors, in contrast to the long standing view of scientific knowledge, "a public good", as immediately accessible to all.

An article in The OECD Observer (April/May 1988) surveys the variety of ways in which universities and industry seek mutually profitable connections. Several universities in many O.E.C.D. countries have established special units to seek research contracts with industry, to patent the inventions of their researchers, to license technology to business enterprises, and to

form joint ventures with industry and financial institutions to exploit their research commercially.

Examples cited are numerous, Oxford University created a company to enable it to benefit financially from the research of its scientists and engineers. The Universities of Bergen and Oslo are involved with industry and private research institutes in establishing research foundations to be financed by a stockholding company.

The University of Catania is planning a joint venture with an Italian semiconductor company for a research and development facility devoted to the development of Very Large Scale Integration Technology. In Spain the Polytechnic University of Catalonia has built extensive contractual relations with local companies for research which now accounts for 20-25% of the institution's total budget and helps to provide fellowships for advanced students.

Science parks have been set-up in Sweden in connection with five universities including Gothenburg, Lund and Uppsala. The Universities of Leuven, Ghent and Brussels have created an independent institute for Research and Development in advanced micro-electronics which does work for industry. Moreover, in the Netherlands the University of Leiden has produced a Bio-Science Park to act as a center for research and product development in biotechnology.

In addition academic institutions undertake joint research projects with institutions in other countries and accept grants and research contracts from foreign firms. For instance, Ajinomoto Co. (Japan) is financing a 5 year research project on immunology and cell biology at Massachusetts Institute of Technology. Hoechst Chemical Co. (Germany) is providing 50 million dollars for a molecular biology project at Harvard University and Squibb Pharmaceutical Co. (U.S.A.) grants 32 million dollars to Oxford University for research in neuropharmacology and Monsanto 5 million to Oxford for the Bio-Chemistry department.

Furthermore, universities develop special training courses for industry. British universities, for example, in the 1980's tripled such income in a four year period and the University of Salford, in particular, increased such income tenfold.

A path to unity of Europe may be detected in these relations of

industry and research and economic policy to higher education in individual countries but certain constraints must be noted.

The "sophistication factor" which leads to growing equipment and consumable costs per employed researcher makes research highly expensive.

While some countries like France and Germany place most basic and strategic research in specialist institutes, linked to the higher system by the fact that professors and lecturers hold positions in their university departments and also in relevant research institutes, high status is not invariably a formal research function - witness the Grandes Ecoles and certain prestigious liberal arts centered colleges.

Not all universities have or should have the same role and functions and undertake the same range of research activities - nor should all nations be the same in their research policy. Many universities or colleges could simply teach, synthesize and disseminate existing knowledge, contract work for industry, do "update study" or "monitor" rather than basic research. Consequently there should be greater differentiation among European universities, urges an O.E.C.D. report assessing the role of research education. This could be done within a nation, within a region - Mediterranean or Northern Europe, for example, or within the Community (twelve countries).

Other kinds of distinctions among nations can be made. What proportion of gross domestic product is devoted to basic, strategic and applied research? How much of each type is done in universities, specialist research institutes, government departments, private sector and non-university education?

Roger Geiger has reminded us that while the university was the predominant home of science for about a century, it is no longer because the vast proliferation of modern science cannot be contained within the confines of the university and because the enormous expansion of higher education has brought about departures from the university model. Undisputed are the strengths the university has brought to research-training, synergism of teaching and research, intellectual autonomy, critical evaluation in a university setting,

dynamism of the university community and complementarity of universities and disciplines. The weaknesses, however, are also significant - wastefulness, inability to do "big science", to provide the necessary concentration of researchers on a particular topic, limitations as an arena for enlarged or interventionist science policy. Geiger concludes that the university should be mainly the home for practitioners of the basic disciplines and after that possibly a haven for, among other things, applied science. However he does not consider whether individual universities or individual countries can have different "mixes" of pure and applied research policy.

To continue with problems and issues held in common by European countries, one must be aware that in addition to these structural values, professors in academia are particularly concerned with whether researchers are relinquishing too much control to industry, inhibiting the free and open inquiry people in universities have traditionally enjoyed, whether researchers will be devoting most of their energies to solving short term problems for industry rather than engaging in less practical but often more important basic research. There is, moreover, the potential conflict between freedom of inquiry and timely communication of scientific findings and the protection of industry's need to ascertain the potential patentability of technical developments.

Another mutually recognized issue looming large in the research planning policy of countries of Europe is that of the changed nature of graduate training. Incorporating industry/government contracts research programs into a steady state graduate operation decreases the quality of other essential graduate programs. The fear is that industry-sponsored research brings a team approach and linkage that works against the classic single mentor-graduate student structure. Will the traditional precepts and objectives of graduate training be overwhelmed by the highly selective and focused industry/government sponsored research contracts apparently necessary to meet the expense of the "state of the art" laboratory equipment, thus sharply lowering the quality of the science graduate's training?

Industry administrators think the problem of industry/university relations is one of management, asserting that the traditional collegial governance and structures of disciplines are of little

interest to industry based on hierarchy and seeking workable solutions mainly by a multi-disciplinary approach. They willingly agree to the price for keeping to "state of the art" instrumentation subsidized by industry/government, namely, erosion of autonomy and fusion of more specialized graduate training into a team approach.

Exploration of possible modes of attaining unity on research policy for Europe must also evaluate the relation between centralizing and decentralizing factors. For a single nation such as Sweden in the centralization vs. decentralization controversy, strong initiatives were taken at the center as the necessary guarantors of program continuity, supply of personnel, and equipment which the local level needs in order to carry out "quality" research on a long-term basis. Can or should such inter-action be carried out within the twelve member countries of the Community?

To continue, business enterprise in Sweden does 65% of research and development, higher education 30% and government 5%. In recognition of this division, Sweden established three categories of research - sectoral where research is to inform developments in all segments of society, from health, environmental protection and industrial evolution to defense and education; decentralized - where decisions including implementation of research policy are taken by independent government agencies and by units e.g. university departments which perform research, and pluralistic - in which research is financed through decisions reached in many different governmental and non-governmental areas.

To coordinate research policy, the Swedish government built policy planning networks and used corporate management techniques (e.g. information technology and cost/benefit analysis at central and local levels). Despite several years of fiscal crisis, Sweden increased the budget for research. Sectoral research and development increasingly are devoted to social as well as technical issues (international development cooperation, work environment, environmental protection, occupational health and safety).

They followed the "deconcentration" principle which permits greater participation of states and localities in planning while leaving the guiding lines and significant control instruments in the hands of the center. Politically, research had priority at

the highest level; administratively a strong, rational, efficient organization was established. Technically, the need for information, statistics and other macro analyses of research and development and program evaluation was recognized.

To achieve this, the research community secured the right to be represented - if possible by majority - in the different resource distributing agencies. But it was sectoral research that became dominant; its rise and eventual victory have meant that traditional research more or less accepted political and bureaucratic definitions of what is considered as "socially relevant research". This prevailed for a time in Sweden. But is "sectoral research" that which may draw to it a sense of unity, or is it sufficiently politically aligned (social democratic support) to be divisive in nations with strong conservative or Christian Democratic bias?

For Sweden this preference was integrated into a system that wanted a maximum of "practical" research in the shortest time possible. This affected those distributing funds and allocating other resources in traditional academic research. It brought about a formalized system of choosing relevant and "worthy" research projects. Since the Social Democrats apparently moved too far in giving priority to practical, sectoral, monitor research, the pendulum has moved back to emphasis on basic, pure research. Whatever the emphasis, the research community secured the right to be represented - if possible by majority - in the different resource distributing agencies.

Another trend that will work toward unity is the European Institute of Technology - a research network to be created by major European Technology Companies and European branches of IBM and A.T.&T. This will promote greater collaboration among academic and individual researches in Europe. With a central office in Paris, it will finance research relevant to long-term needs of sponsoring companies. The objective is to strengthen individual research, development and competitiveness in Europe, using Europe's university system as well as its national and corporate laboratories.

The Council consists of chairmen and presidents of large corporations, each of which is to contribute \$250.000 a year for

two years - Philips, Thomson, ASEA, Montedison and Royal Dutch Shell have already signed up. Interested higher education institutions which are already members are Cranfield Institute of Technology, Universities of Cambridge, Sussex and Surrey, Ecole Nationale Supérieure des Mines (Paris), Universities of Grenoble, Paris XI and Technological University of Compiègne. Representatives of twenty-five European Universities meeting in Paris in 1987 agreed to support efforts to establish European Institute of Technology.

The operating assumption of the Institute is that Europe is weaker than United States or Japan in turning research results into development of new products. The mode of operation is to have competitive submission of ideas for research groups, then to issue initial seed grants to draw up detailed proposals with ultimately five to ten proposals receiving 1.2 million ECU's a year for the first three years.

The Institute will complement activities started by the European Community, the main difference being selection of the institute's research by private corporations rather than by governments. It will lobby the Community and individual European parliaments on issues affecting relationships between universities and industry.

An additional motive for establishing the European Institute of Technology may be to dilute the traditional university's hostility in Europe to applied research and industry by linking universities more closely to industry. The Institute would constitute a small scale effort to break down that barrier. The cross-national procedures for high technology, the rapid growth of EUREKA within the Common Market and the increasing acceptance of the concept of Europe Incorporated instead of the United States of Europe also tend to weaken the wall between university and industry.

Ladislav Cerych has suggested that among the factors explaining the increasing collaboration between higher education and industry are the end of the 1968 student movements, growing awareness of the unsuitability (for industrial purposes) of any traditional university courses, including those in science and technology and disappointment with the reforms of the late 1960's and early 1970's. He believes that relations between industry and universities have less to do with institutional arrangements, legislation or formal mechanisms than with personal relationships established

between lecturers and former students now engineers or managers. This, he thinks, has prevailed far less in Europe than in Japan and U.S.A.

The five mechanisms for collaboration are science or industrial parks, intermediary bodies especially involving regional small and medium sized firms, industrial liaison offices, teaching companies for in-company training and as "agents" of technological transfer and university initiated industrial companies. But Cerych too notes the European universities' traditional disregard for jobs in industry and continuing effort to prepare students for civil service, church and professions - thus retaining psychological barriers to a symbiotic connection between university and industry.

Of course, these activities look forward to bringing down European barriers in preparation for the single market in 1992 with free movement of people, capital, goods and services. Transitional cooperation among higher education institutions and industry would strengthen the identity of Europe as a trade force and increase its stability to compete with Japan and the United States. The COMETT program as a response to technological change encourages training and re-training on a transtional scale, leading to an exchange of experience between E.E.C. states and improving the supply of training on local, regional and national levels. Developing the links between higher education and industry leads to a network of permanent installations across Europe ready to play their full part in the achievement of the single market in 1992.

When one scrutinizes proposed and actual reforms, for example, in higher education, the recognizable similarity of agenda for European nations also suggests a path to unity. The proposal, for example, to create a diploma qualification between the maturita and the laurea in Italian institutions which could be completed in two years' full-time study or three years' part-time study which can be taken by all students is matched by similar activity in other European nations.

A better relationship between university and secondary school education is a priority topic for most European countries as well as the connection between secondary and higher education systems and employment situation. Another concern held in common is the participation of the external community in the management and development of post-secondary education structures. These

"social councils" are proposed to have wide powers and include representatives from various sections of society.

This brief survey and limited analysis has attempted to show the changing relations between universities and industry, government research policy in Europe. It is not yet clear whether the challenge focus the sense of European unity by identifying the commonality of problems and solutions or accentuate disunity by the growth of competitiveness. If the competitiveness is between Europe and Japan and the United States, obviously unity will dominate. If competitiveness is between bilateral conglomerates within Europe, disunity will be the result. If there is a rationalized plan of differentiated mixes or differentiated models of pure and applied research and different science and technology curricula emphasized, depending on the strengths of the particular university and on the varying contexts and sizes of the countries, then that diversity can add up to unity. If universities regardless of quality, or nations regardless of gross national product or population numbers or stage of development attempt to replicate each other, then disunity will prevail.

Moreover the success or failure of such cooperative enterprises in Europe as CERN, EUREKA, COMETT, EURYDICE, IMP's, or E.I.T. will affect any trend toward unity or disunity as the E.E.C. moves toward the single market and 1992. It is clear that decisive political, social and economic problems of today can no longer be resolved at the national level; therefore the march toward that fateful year, it can be wished, will see the triumph of cooperative or cross-national structures.